Programmes After Market Services (PAMS)
Technical Documentation

NHB–3 SERVICE SOFTWARE INSTRUCTIONS

Original 0597

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments

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Service Software Instructions

General

The service software is specially designed to facilitate the servicing of PCS cellular telephones.

The software can be used to control the phone according to the user's wish merely by entering commands via the keyboard of a PC/AT connected to the phone.

This section refers to PCS Service Software Version 0.1 To receive a free upgrade, please follow the de–install instructions in Appendix I and send the disk to Nokia Mobile Phones.

Required Servicing Equipment

– Computer: IBM PC/AT or compatible with one unused serial port (COM1 or COM2) *), one parallel port (LPT1), hard disk recommended
– Operating System: DOS Version 3.2 or later
– Display: Any 80–character text display
– Service Software for 3.5" disk (product code: 0774024) or for 5.25" disk (product code: 0774025)
– Software protection key PKD–1 (product code: 0750018)
– M2BUS adapter DAU–2 (product code: 0750006)
– Modular cable XCM–1 (product code: 4626131)
– RS–232 adapter, 9–to–25 pins (product code: 4626170)
– Service cable SCS–1 (product code: 0770010)
– Service box JBS–7 (product code: 0770015)
– Power connector PCS–1 (product code: 0730012)
– Audio cable ADS–1 (product code: 0730011)

*) Note: A number of PC's of an older generation use the Intel, National Semiconductor, or United Microelectronics IC 8250 as the serial port UART. This is a comparatively inefficient circuit for current purposes and does not necessarily support the M2BUS adapter at 9600 baud. The newer UART's NS16450 and NS16550AF of National Semiconductor offer solutions for these problems.

Mechanical Connections

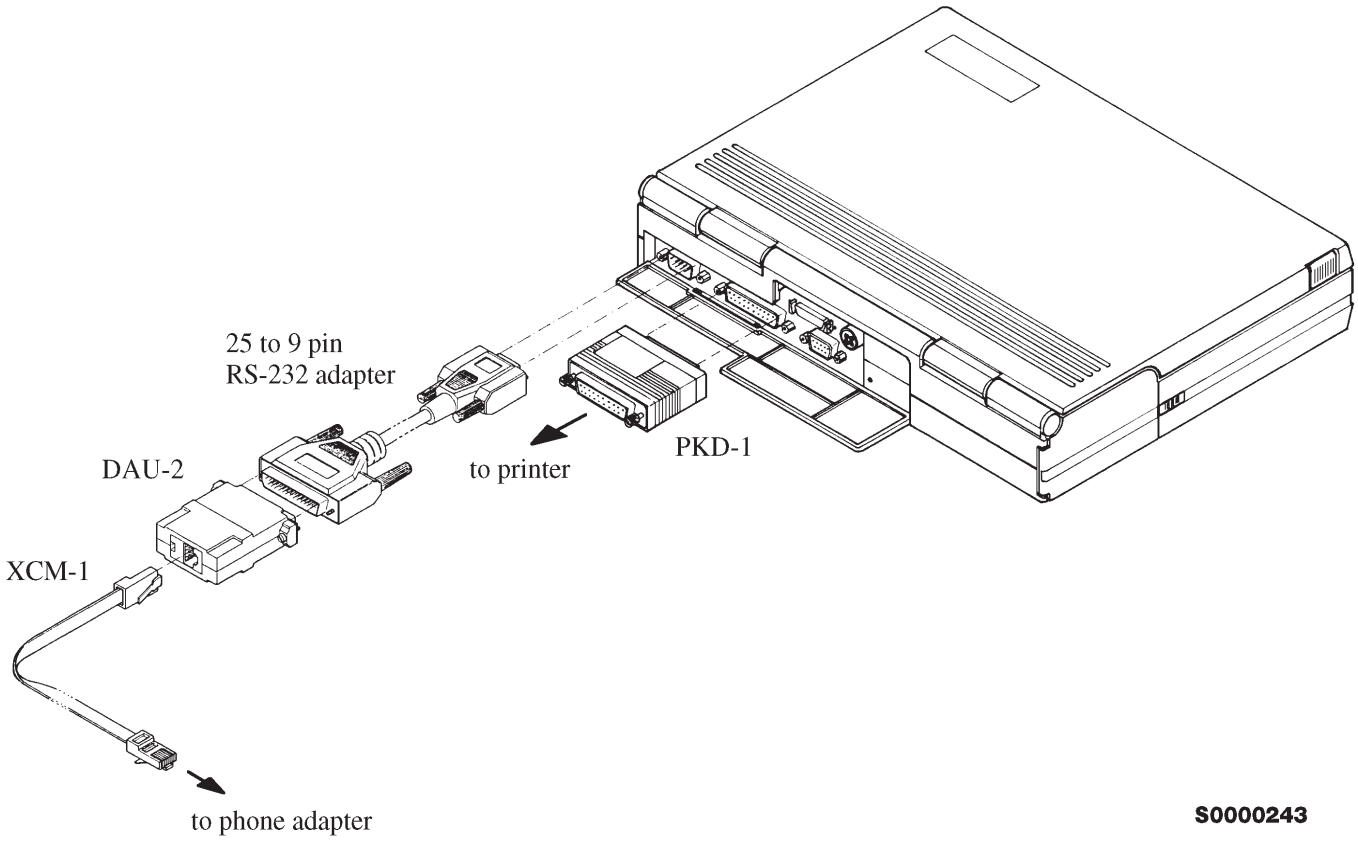
Caution: Make sure that you have switched off the PC and the printer before making connections !

Caution: Do not connect the PKD–1 key to the serial port. You may damage your PKD–1 !

The software controls the phone via a separate adapter connected to the serial port of the PC and to the telephone's M2BUS (DAU–2 and XCM–1).

Attach the protection key PKD–1 to parallel port one (25–pin female D–connector) of the PC. When connecting the PKD–1 to the parallel port be sure that you insert the PC end of the PKD–1 to the PC (male side). If you use a printer on parallel port one, place the PKD–1 between the PC and your printer cable.

The PKD–1 should not effect devices working with it. If some errors occur (errors in printing are possible) please try printing without the PKD–1. If printing is OK without the PKD–1 please contact your dealer. We will offer you a new PKD–1 in exchange for your old one.



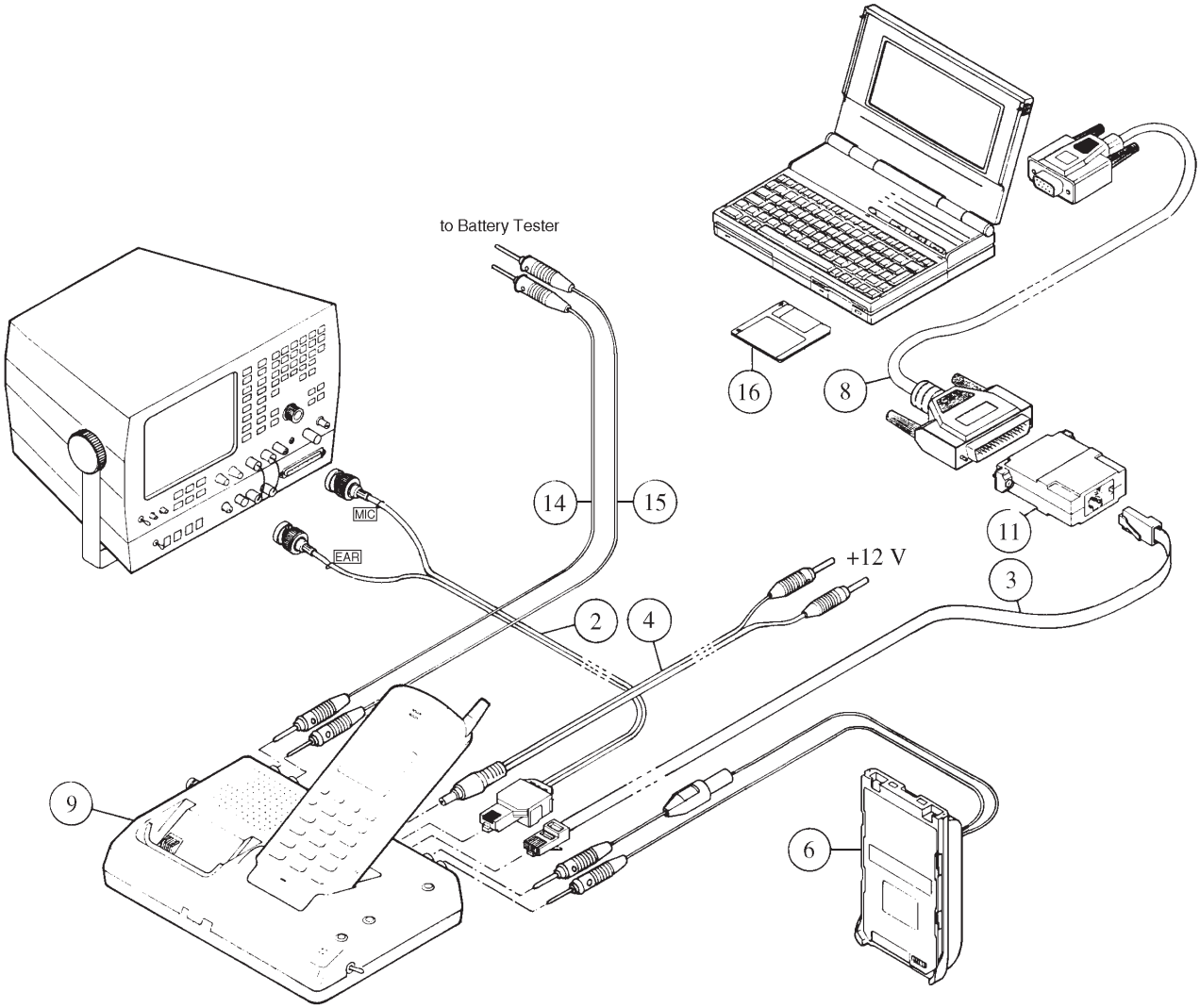
Connect the M2BUS adapter (DAU–2, item 11) to the serial port (25–pin male D–connector). In case your PC (as AT types in general) has a 9–pin serial port use the special connector adapter cable provided (item 8).

Then connect the modular cable XCM–1 (item 3) from the M2BUS adapter to the modular connector of the service box JBS–7 (item 9).

Now connect the transceiver NHB–2 to the service box. Then attach the service box's RF connector to the measurement station by using the RF–antenna adapter + RF cable (TDA–1), if needed.

Then connect external audio lines of the JBS–7 to the measurement station by using the audio cable ADS–1 (item 2).

Connect service box to the power supply by using power cable PCS–1 (item 4). The voltage must be set to 12 V.



Starting

Start the phone by pressing the power on button of the handset. Switch PC power on.

To start the program on diskette, proceed as follows:

1.	insert the service software diskette into drive A: of your PC	
2.	log into drive A:	*type A: and press <Enter>*
3.	start NHB2SERV.BAT and run the service software	*type **NHB2SERV** and press <Enter>*

To start the program on hard disk (if installed), proceed as follows:

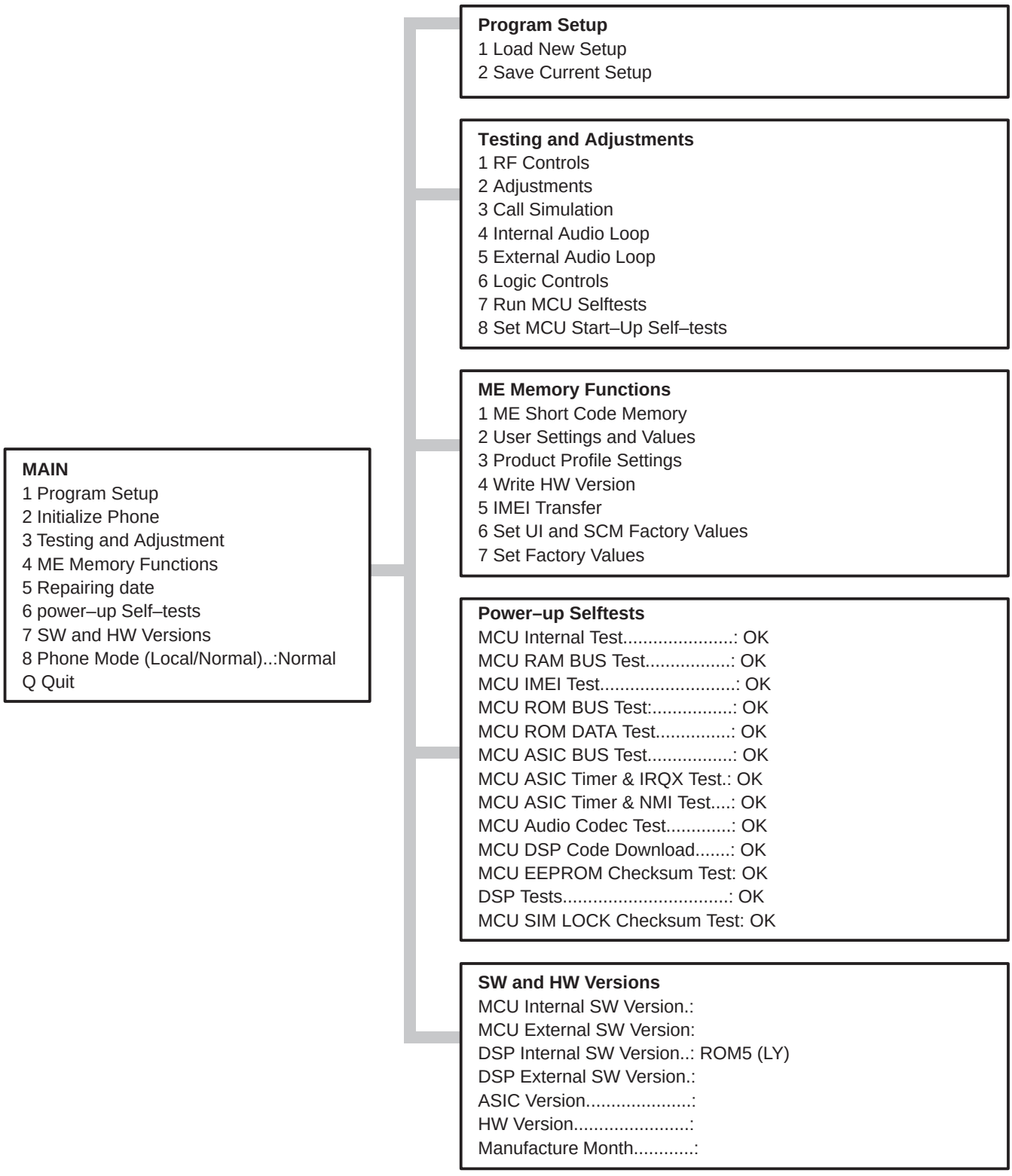
1.	log into drive C:	*type C: and press <Enter>*
2.	start NHB2SERV.BAT and run the service software	*type **NHB2SERV** and press <Enter>*

Note: See installation instructions in Appendix I.

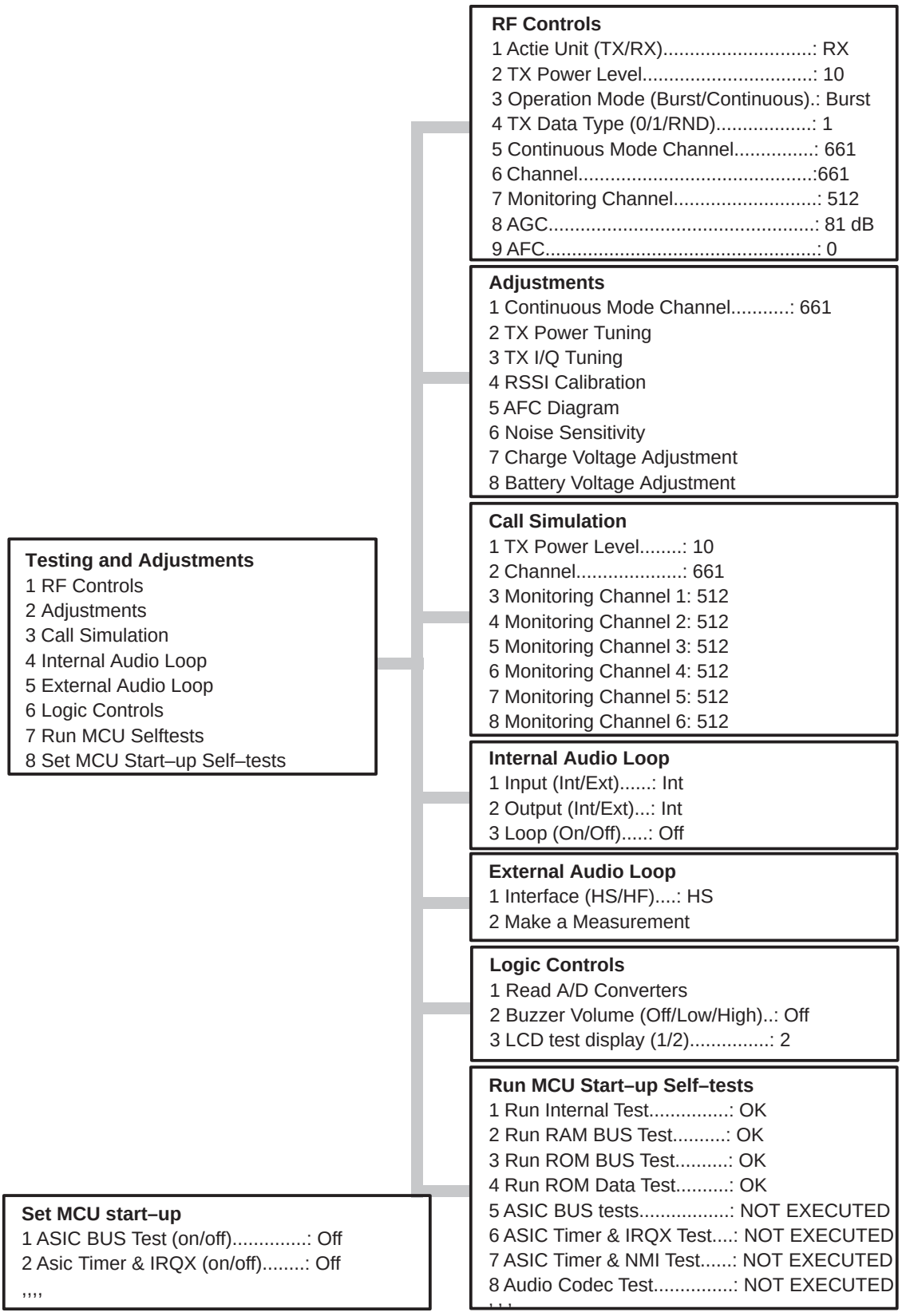
Note: For more information on PCLocals starting options, see Appendix II.

The service software version can be seen on the screen. Press <Enter>; the phone begins to scan the PCS channel. If the phone cannot find the correct reference channel, press <Esc> to seeing the main menu.

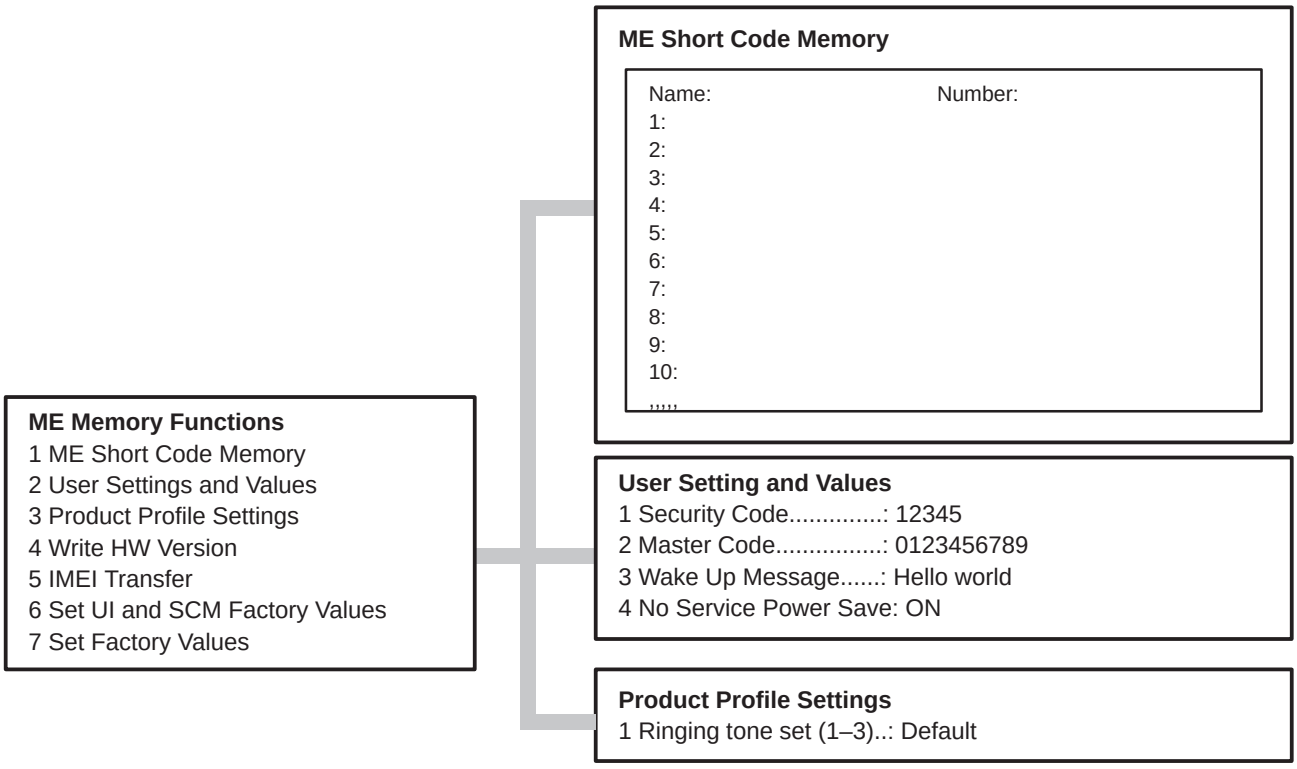
Service Software Menu Structure, Main Menu



Service Software Menu Structure, Testing and Adjustment


Testing and Adjustments
1 RF Controls
2 Adjustments
3 Call Simulation
4 Internal Audio Loop
5 External Audio Loop
6 Logic Controls
7 Run MCU Selftests
8 Set MCU Start–up Self–tests
RF Controls
1 Actie Unit (TX/RX).....: RX
2 TX Power Level.....: 10
3 Operation Mode (Burst/Continuous).: Burst
4 TX Data Type (0/1/RND).....: 1
5 Continuous Mode Channel.....: 661
6 Channel.....:661
7 Monitoring Channel.....: 512
8 AGC.....: 81 dB
9 AFC.....: 0
Adjustments
1 Continuous Mode Channel.....: 661
2 TX Power Tuning
3 TX I/Q Tuning
4 RSSI Calibration
5 AFC Diagram
6 Noise Sensitivity
7 Charge Voltage Adjustment
8 Battery Voltage Adjustment
Call Simulation
1 TX Power Level.....: 10
2 Channel.....: 661
3 Monitoring Channel 1: 512
4 Monitoring Channel 2: 512
5 Monitoring Channel 3: 512
6 Monitoring Channel 4: 512
7 Monitoring Channel 5: 512
8 Monitoring Channel 6: 512
Internal Audio Loop
1 Input (Int/Ext).....: Int
2 Output (Int/Ext)...: Int
3 Loop (On/Off).....: Off
External Audio Loop
1 Interface (HS/HF)....: HS
2 Make a Measurement
Logic Controls
1 Read A/D Converters
2 Buzzer Volume (Off/Low/High)..: Off
3 LCD test display (1/2).....: 2
Run MCU Start–up Self–tests
1 Run Internal Test.....: OK
2 Run RAM BUS Test.....: OK
3 Run ROM BUS Test.....: OK
4 Run ROM Data Test.....: OK
5 ASIC BUS tests.....: NOT EXECUTED
6 ASIC Timer & IRQX Test....: NOT EXECUTED
7 ASIC Timer & NMI Test.....: NOT EXECUTED
8 Audio Codec Test.....: NOT EXECUTED
Set MCU start–up
1 ASIC BUS Test (on/off).....: Off
2 Asic Timer & IRQX (on/off).....: Off
,,,,

Service Software Menu Structure, ME Memory Functions



Using Menus

All menu selections have a separate selection character in the first column. This character is a number, a letter or a special ASCII character (e.g., <+> or <–>). Menus have a fixed constant display structure, i.e. the texts cannot be scrolled.

You can select a function from a menu in two different ways. The first way is to press the key on the PC keyboard corresponding to the first character of the line. The other way is to move the cursor from line to line using arrow keys and make the selection with the <Enter> key.

When you have made your selection the new menu or window will appear on the PC screen. Every menu and window carries a name on the topmost line. The name is the same as the selection in the previous menu or window. When the new menu is activated the old one will disappear.

When a window is activated the selectable keys are seen in the window. Windows may have a scrolling or a constant display.

Common control key symbols are always seen on the help line (line 25) and the keys may be used always when seen on the last line.

With a window or menu active the <Esc> key is pressed to quit selection, put out the window or menu and bring the previous menu or window to the display. The <Esc> key doesn't have any effect when it is used with the main menu. When editing data the <Esc> key can be used as interrupt key. During edition the <Enter> key is used as exit key.

Help Functions

The last line (line 25) will always list the special keys which can be used. The help key <F1> can be used anytime when the menu is on the display. When the help key is used a new window will appear on the screen. The new window contains a text that describes the function over which the cursor was when the help key was used. The <Esc> key will move the cursor back to the menu and the help window will disappear.

Text Editing Windows

When you have made a selection which needs some additional information, the basic text editing window is activated.

The text editing window may have one or more editing lines. The length of the line varies depending on the function. When the window is activated the text which was previously in that window (default text) reappears on the screen.

The following key selections are possible:

Key	Function
<Enter>	Selects the text in the window; the editing window is turned off. The selected text will be the default text of the selection.
<Esc>	Interrupts editing; the previous menu is shown and the default text won't be updated.
<Ins>	Toggles the editing mode between insert and overstrike modes. The last line of the screen tells the current editing mode. When editing ends the editing mode is retained and same mode is used again when editing text.
<←>	Arrow keys (right shift and left shift) move the cursor. The
<→>	cursor moves as if the lines were positioned one after another. For instance right shift causes the cursor to move from the last column of the first line to the first column of the second line. If the right shift is used and the cursor is at the last position of the last line, the cursor is not moved. Similarly, the cursor does not move with the left shift key when it is at the first position of the first line.
<Home>	Moves the cursor to the start of the text.
<End>	Moves the cursor to the end of the text.
<BS>	The backspace key has two different meanings depending on the editing mode; • When the overstrike mode is activated the <Backspace> key moves the cursor back and changes the character under the cursor into a space. If the cursor is at the first position of the first line nothing happens. • When the insert mode is activated the <Back space> key moves the cursor back and deletes the character under the cursor so that all characters after the deleted character are moved one position back. If the cursor is at the first position of the first line nothing happens.

<Del> Has also two different meanings depending on the editing mode;

- When the overstrike mode is activated the <Del> key changes the character under the cursor into a space and moves the cursor for ward. If the cursor is at the last editing position of the last line nothing happens.
- When the insert mode is activated the <Del> key removes the character under the cursor so that all characters after the removed character are moved one position back. If the cursor is at the last editing position of the last line nothing happens.

<F1> Function key number 1 activates the help window.

<F4> Clears text in the editing window.

Service Software Menu Commands

When you start the Service software, the main menu can be seen on the screen. There are eight main functions;

The phone should be in the local mode for the third and fourth functions. (After the program has started the phone automatically assumes the PCS mode). You can change phone mode by choosing function ”7 – Phone mode”.

The number identifier of each title refers to a main– and a sub–menu item. E.g., in **3.1.2 TX Power Level**; the first number (3) refers to the third block ”3 – Testing and adjustment” of the main menu. The second number (1) refers to the first block ”1 – RF control” of the testing and adjustment menu. The third number (2) refers to the second block ”2 – TX power level” of the RF control menu.

1 – PC Setup

When save setup is selected the basic text window is made and the program asks setup file name. The setup information is saved when the name is ended with <Enter> key. The saved information includes all next selections (on mentioned menus or windows) and parameters:

– RF Controls menu
  • All selections
– Call Simulation
  • All selections which are not same as in the RF Controls menu
– Tuning parameters
  • TX power coefficients
  • Power connection diagram
– Run MCU Self–tests
  • All selections

Next selections are **not saved** to setup file:

– Main Menu
  • Phone Mode (Start value = Normal)
– PC Setup menu
  • Default name for setup file
    (Start value = NHE_4.CON)

– Internal audio loop:
  - input (Start value = Int)
  - output (Start value = Int)
  - loop (Start value = Off)

– External audio loop:
  - interface (Start value = HS)

– Logic controls
  - Buzzer Volume (Start value = Off)
  - LCD Test Display (Start value = 1)

Load function generates same kind of basic text window as save function and asks setup file name. When the name has been give and <Enter> key has been used the file is loaded and all previously told selections and parameters are replaced with the values taken from the file. This has same effect as command line parameter –f.

Both save file and load file function has default name which is previously used name. For instance if setup was saved to file CONF.CON and load function is activated the default value is CONF.CON. If only ENTER key is pressed default value is used. If <Esc> key is used the function will be interrupted. If invalid DOS filename is used or there isn't load file with given name error message will come to the display.

If phone mode had Local value before setup file loading, the mode is changed to Normal in the phone by special Normal mode message and all functions caused by the change are done.

Every time when phone mode change message from Local to Normal is received by MS it makes reset to the whole MS.

2 – Initialize Phone

With this function you can initialize the phone to accept M2BUS commands from the PC. This function should be used right after the phone is connected to PC and powered up.

The initialization function performs the following subfunctions:

– MBUS registration
– Test mode message sent to the phone
– Phone mode set to PCS

3 – Testing and Adjustments

When testing and adjustment menu is selected, the phone mode must be set to the ”Local” value.

Caused by the test interface slowness when M2BUS is used there may be some delay between the user interface updating and the register controls in the hardware.

3.1 – RF Controls

RF Control Information Window

When RF controls menu is activated, the information window will be generated and it is updated when information is changed. This window is removed when exit is made from RF controls menu. The shown window type is used when burst operation mode is selected.

The text in the window has same meaning as in the selection menus. TX Power have value OFF or transmission power as PCS value. When the TX power is tuned with test value (smallest value) the TX Power has value TEST.

AGC value is shown only when its value is controlled by PC. When Active Unit has value RX and Operation Mode is continuous, AGC is controlled by PC except when next adjustment functions are activated:

– RSSI calibration
– AFC diagram

AFC value is shown only when its value is controlled by PC. When Active Unit has value RX and Operation Mode is continuous, AFC is controlled by PC.

The next table shows the information window display on different situations:

Active Unit = TX	Operation mode = BURST	Not operate continous mo
TX Power Level: TX Data Type: Continuos Mode Channel: Channel: Monitoring Channel: AGC: AFC:	Updated Updated Removed Updated Removed Removed Removed	

Active Unit = RX	Operation mode = BURST	Operation mode = CONT.
TX Power Level: TX Data Type: Continuos Mode Channel: Channel: Monitoring Channel: AGC: AFC:	OFF Removed Removed Updated Updated Removed Removed	OFF Removed Updated Removed Removed Updated Updated

3.1.1 – Active Unit

Either receiving or transmission tests can be selected. When TX is selected, the following functions will be performed:

– Data type is activated
– Operation mode is burst
– TX power is activated
– TX channel is activated
– Information window is updated
– Monitoring channel is updated

When RX is selected, the next funtions are made:

– Data transmission is deactivated
– TX power is deactivated
– If operation mode is continuous,
  – AGC is controlled
  – AFC is controlled
  – Continuous mode RX channel is activated
– If operation mode is burst,
  – RX and monitoring channel are activated
– Information window is updated

3.1.2 – TX Power Level

With this function it’s possible to change the transmission power. The user can select the needed PCS power value (0...15) by pressing arrow up / down keys and ENTER. Power value is stored to EEPROM. The test value or base level selection is made by writing ”T” or ”B” with small or capital letters.

3.1.3 – Operation Mode

With this function it's possible to change the operation mode. The operation mode is burst or continuous. Selection texts are "Burst" or "Cont".

When burst selection is used,

– synthesizer is controlled by using PCS receiving/transmission /measuring synthesizer control sequence
– synthesizer channel numbers are as given with channel/monitoring channel selections
– if active unit is TX, data (selected with TX data type) is sent and TX pwr is running Burst mode.

When continuous selection is used,

– synthesizer is set to constant frequency
– synthesizer channel number is as given with continuous mode chan. selection
– transmitter power is not connected
– if active unit is RX, AGC is controlled

3.1.4 – TX Data Type

This function changes the transmission data type. Data types are 0,1 or random. Operation mode can be only Burst mode.

3.1.5 – Continuous Mode Channel

Continuous mode may have all PCS channel numbers (512...810). The used frequency depends on the active unit. If active unit is RX, then RX frequency is used, else TX frequency.

3.1.6 – Channel; Monitoring Channel

"Channel" selection numbers are used for both transmission and receiving. Monitoring channel is selected separately for neighbour monitoring channel. All PCS channel numbers (512...810) are valid.

3.1.7 – AGC

The AGC can have values (0...93 dB) by 3 dB steps. If the number is not divisible evenly by 3 the number is rounded to the next bigger number divisible by 3. The AGC can be edited or stepping one by one with <+> and <–> keys.

3.1.8 – AFC

With this selection user can set AFC D/A converter value. The AFC can have values from –1024 to 1023. The AFC value can be edited or stepping one by one with <+> and <–> keys.

3.2 – Adjustments

If EEPROM fault is noticed when local mode was selected, it is not possible to select adjustments menu.

All adjustments which have EEPROM saving selection have the next kind of behaving with <F2> and <Esc> keys:

When adjustment function is activated and <F2> key is used the program will ask are the values saved to the EEPROM or not. If <Y> key is used, adjustment values are saved to the EEPROM. If <N> or <Esc> key is used the adjustment can be continued. Nothing happends if any other key is used.

When <Esc> key is used during adjustment function, the program will ask are the values saved to the EEPROM or not. If <Y> key is used, adjustment values are saved to the EEPROM and exit from the function is performed. If <N> key is pressed exit will be performed without saving the values to the EEPROM. If <Esc> key is used the adjustment can be continued. Nothing happends if any other key is used.

3.2.1 – Continuous Mode Channel

Continuous mode channel number can be selected from adjustments menu. The real frequency (transmission or receiving frequency area) depends on the active unit selection and the selected tuning function. Note that this is same selection as in the RF controls menu.

3.2.1 – TX Power Tuning

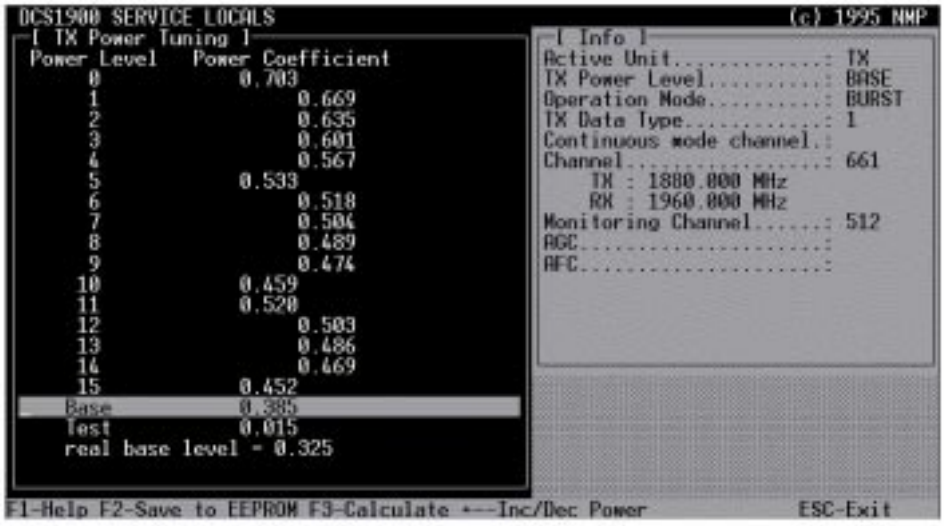
This function is used for tuning power levels.

The next question is made to the user:

```
Values from EEPROM? (YES/NO) _
```

The user is also informed that TX power will be connected to biggest value if he does not break the selection with <Esc> key.

If <Y> key is used, tuning values from EEPROM will be loaded. If <N> key is given, the values which PC program normally uses when DSP is controlled will be used. If <Esc> key is used the selection is interrupted and the previous menu is shown on the screen. Nothing happends if any other key is used.



The next tuning window will be activated automatically after value selection. The power is presented in PCS values (0...15) and the TX power base level indicated by ”base” text. The base level is selected automatically when the function is started. The test value is always same when the function is started first time after PCLocals start–up. The test value is not saved to the EEPROM. The test value can be changed during tuning as other power coefficients and the program remembers its value when tuning function is activated later again.

There is one selection which is used for power coefficient calculation. Only five power coefficients (Power levels 0,5,10,11 and 15) are needed to tune and the rest of them will be calculated.

The calculation is activated by using <F3> key. The power coefficients which are calculated from the tuned coefficients are displayed on the different columns than the others. All values can be tuned if needed.

The next automatic selections are made when this tuning function is activated:

– if transmission data is 0, 1 or random then continuous 1 data is selected
– active unit = TX
– the base power level is selected
– operation mode = burst
– channel = 661

The cursor is shown on the tuning position. Next value is selected with arrow keys.

arrow keys will cause power changing. When these keys are used the coefficient value is updated on the tuning window.

When save or exit selection is used, the power value checking is made and if it is not succeeded, error message is shown. The test checks if all power coefficient values are in the same bigness order as power levels in the table.

When TX power tuning is ended and if the power values are not acceptable, the error message is displayed and the user is asked to continue or break the tuning. The next answers and responses are in use:

Key	Response
N or Esc	The tuning is continued
Y	The tuning is ended without EEPROM writing and power coefficients are asked from EEPROM (this is also informed to a user)
other key	–

If the power tuning function is ended and EEPROM values are not received or EEPROM fault is noticed, an error message is shown. Error message asks to check M2BUS interface or set factory values. When any key is pressed, adjustment menu is selected and PC values are used as power coefficients, even though they have wrong values.

If the TX power tuning is ended and power coefficients are acceptable, the behaving of the PC SW is following:

Key	Response
Y	The coefficients are written to EEPROM and tuning is ended
N	The tuning is ended without EEPROM writing but the tuned coefficient values are used when RF controls are used
Esc	The tuning is continued
other key	–

When all power coefficients have such values that they don't cause any error messages, exit can be performed. The last used tuning power is in use after exit. When values are saved to EEPROM.

The next automatic selection is made when this tuning function is ended:

– active unit = RX

3.2.3 – TX I/Q Tuning

This function is used for tuning TX I and Q branch DC offset, amplitude difference and phase difference.

The function causes the same question about values (from EEPROM or PC) as power tuning.

The next automatic selections are made when this function is activated:

– active unit = TX
– operation mode = Burst
– TX power level = 5
– if TX data type= RANDOM => TX Data Type= 1
– channel = 661

The next menu is displayed after the answer.

User can tune the current value with the arrow right and left keys.

After each value change the new value are send to the phone.

The next automatic selection is made when TX I / Q tuning function is ended:

– active unit = RX

3.2.3.1 – Tune TX I DC Offset

The DC offset is shown as precentages (%) from the maximum value. 0 % means that there is no DC. The value range is –100 %...100 %. The value is rounded to the nearest integer value.

3.2.3.2 – Tune TX Q DC Offset

The operation of this function is the same as one above, except with this selection the Q branch DC offset is tuned.

3.2.3.3 – Tune TX I and Q DC Offset

The operation of this function is the same as one above, except with this selection the both I and Q branch DC Offset is tuned. When plus <+> or minus <–> –key / (arrow keys left or right) has pressed the both values are changed to the same direction. If another value is in the limit value it does not change, but the other value will change.

3.2.3.4 – Tune Amplitude Difference

When this selection is made user can increase or decrease the amplitude difference within 0.1 dB steps. The current amplitude difference is shown on the tuning window with numbers and bar figure.

3.2.3.5 – Tune Phase Difference

When this selection is made user can increase or decrease the phase difference within 0.5 steps. The current phase difference is shown on the tuning window with numbers and bar figure.

3.2.4 – RSSI Calibration

When function is activated the selected channel is checked. If none of the receiving channel numbers from 512 to 810 in PCS mode is selected then error message is shown and the user is asked to change the channel to the valid receiving channel area.

The next automatic selections are made when this tuning function is activated:

– active unit = RX
– operation mode = continuous

The user is asked to set the level of the signal generator to the low level 75 dB and to press <Enter> key. First measurement will be performed. Next the user is asked to set the level of the signal generator to the high level 45 dB and to press <Enter> key. Second measurement will be performed. If the user presses <Esc> key to either of the questions the exit step will be performed and the previous menu is shown on the screen.

The gain code can have values between 0 and 1023 and voltage from 0.25 V to 4.25 V (voltage precision is 0.01 V). Note that the needed input signal level is also shown.

When exit is performed, the following selections are set to the values which they were before this adjustment.

– active unit
– operation mode

The exit and the handling of AGC values are made by the same way (see the following table) as described in TX power tuning.

Key	Response
Y	The coefficients are written to EEPROM and tuning is ended
N	The tuning is ended without EEPROM writing but the tuned adjusted AGC values are used when RF controls are used
Esc	The adjustment is continued
other key	–

3.2.5 – AFC Diagram

The next automatic selections are made when this tuning function is activated:

– active unit = RX
– operation mode = continuous

The following window will appear to the display after the function is activated:

The D/A converter range (DAC) is from +1023 to –1024 and voltage range is from 0.25 V to 4.45 V (voltage precision is 0.01V).

The frequency error range is from –134 kHz to +134 kHz with the precision 0.1 kHz. The rounding is made to the closest value.

When AFC Diagram function is ended and if the measured environment temperature is below zero degrees centigrade, an error message is shown and the user is asked to continue or break the tuning. The next answers and responses are in use:

Key	Response
Y	The tuning is continued
N	The tuning is ended without EEPROM writing
other key	–

When exit is made, the next selections are set to the values which were selected before this adjustment.

– active unit
– operation mode

The exit and the handling of AFC values are made by the following way:

Key	Response
Y	The new AFC value is written to phone EEPROM
N	The old AFC value is written to phone EEPROM
Esc	The adjustment is continued
other key	–

3.2.6 – Noise Sensitivity

This function is used for making Signal to Noise measurement.

The next automatic selections are made when this tuning function is activated:

– active unit = RX
– operation mode = continuous
– AGC = 93 dB in PCS

When this selection is made the next window comes to the display.

Clipping distance is the difference to the signal clipping value. SNR is measured in A/D converter.

Clipping distance = clipping level (66) – signal value + comp_factor1
SNR = signal value – noise value + comp_factor1

Sensitivity = –92 dBm + 8 dB + comp_factor2 – SNR

The last value on the display is signal power difference between I and Q branch. The numbers are shown in 0.1 dB accuracy. The error messages, ”OUT OF RANGE”, are shown only if the SNR and/or amplitude difference values are not acceptable.

SNR <= 18 dB + comp_factor2 – 0.5 dB(=accuracy) ;
Sensitivity >= –102 dBm + 0.5 dB ;
|Si – Sq| > 1dB

When <F2> or <F3> key is pressed, the RX I and Q burst data will be asked. Text ”SIGNAL MEASURING” or ”NOISE MEASURING” will appear in the measurement window and the following help line will be on the last line: ”The power level value should be –92 dBm during signal measurement”

Only <Esc> key is accepted during measurement. <Esc> breaks the measurement routine in the PC and returns the program to the state before pressing of <F2> or <F3>. Normally <Esc> is not needed.

When signal data is received, distance to clipping signal level is shown as dBs on the display. When either signal or noise measurement results are received, ”MEASURING” text is removed and the help line is on the display. When both measurements (signal and noise) are done at least once, the signal to noise relation and difference are also shown on the display.

When exit is performed, the next selections are set to the values which were they selected before this adjustment.

– active unit
– operation mode
– AGC value

Compensation factors:

comp_factor1 = 4.64 dB (Compensation factor for 67.71 kHz signal, because ASIC filter attenuates 67.71 kHz signal 4.64 dB)

comp_factor2 = 2.27 dB (Compensation factor for real and calculated noise bandwidth difference. Real noise bandwidth is 80 kHz and calculated bandwidth is 135 kHz)

3.2.7 – Charge Voltage Adjustment

This function needs 6 V charge voltage from external power supply. When the function is activated the next window will be shown.

The A/D converter has positive 10 bit value.

The A/D converter value is read again when previous value is received and shown on the screen.

If none measurement result is received when <Esc> key is used, the information message is shown. The user can remove the information message with <Y>, <N> or <Esc> key. The measurement will be broken by using <Y> key. The measurement will continue if <N> or <Esc> key is used. Any other key doesn't cause any effect.

When exiting the function the user must answer to the question of saving the values to EEPROM by using the logic described in a next table:

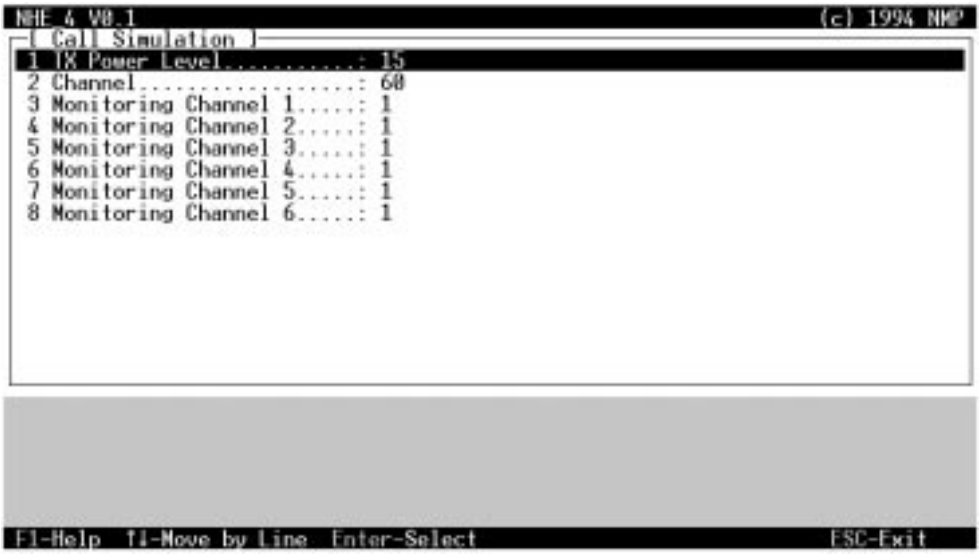
Key	Response
Y	The A/D converter
N	The tuning is ended without EEPROM writing but the tuned adjusted AGC values are used when RF controls are used
Esc	The adjustment is continued
other key	–

3.2.8 – Battery Voltage Adjustment

This function needs 6 V battery voltage from external power supply. When the function is activated the next window will be shown.

The operation is the same as in charge voltage calibration.

3.3 – Call Simulation


NHE 4 V0.1
(c) 1994 NMP
[Call Simulation]
1 TX Power Level.....: 15
2 Channel.....: 60
3 Monitoring Channel 1.....: 1
4 Monitoring Channel 2.....: 1
5 Monitoring Channel 3.....: 1
6 Monitoring Channel 4.....: 1
7 Monitoring Channel 5.....: 1
8 Monitoring Channel 6.....: 1
F1-Help f1-Move by Line Enter-Select
ESC-Exit

3.3.1 – TX Power Level

All power levels (0...15) can be selected. This updates same parameter as TX power level in the RF controls menu. Note that test and base value can't be selected. If test or base value was in use when call simulation menu was selected, power level is changed to the smallest value (15).

3.3.2 – Channel

This informs the normal operating RF channel number. Normal channel numbers can be selected. The same channel number is used both for transmission and receiving. This updates same parameter as channel number in the RF controls menu.

3.3.3 – 3.3.8 – Monitoring Channels

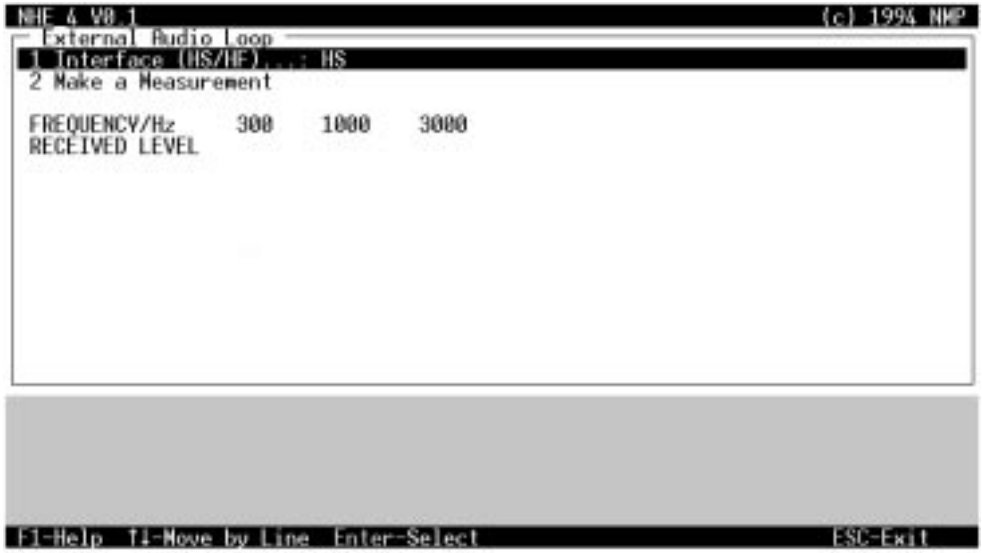
Channels for monitoring are specified with these six selections. All channel numbers can be used. If more than one selection has the same number, the monitoring channel list (neighbour list) will have less than 6 selected channels. The minimum number of monitoring channels is one (all channels have same value). The monitoring channel can also have same value as normal operating channel. The first monitoring channel updates same parameter as monitoring channel in the RF controls menu.

3.4 – Internal Audio Loop

Test interface input and output (internal/external) is possible to select. The third selection connects and disconnects the test loop. The sent audio signal level has constant value which depends on the selected interfaces.

When <Esc> key is used, the internal loop is automatically ended (loop=off).

3.5 – External Audio Loop



The first item selects the interface (internal/external).

The sent audio signal level has constant value which depends on the interface. The frequency is changed, the received signal strength is measured and if too big difference to expected values is noticed, error message is displayed. Three different frequencies are used.

When make a measurement is selected, the received signal strength is displayed (square root of the received value) on the separate window. If any of the shown signal values are out of the below presented accepted scale, the OUT OF RANGE message will be shown.

Frequency	HS interface ref./accepted value	HF interface ref./accepted value
300 1000 3000	25 / 15...35 32 / 22...42 32 / 22...42	63 / 53...73 68 / 58...78 68 / 58...78

Received level data fields have no value before measurement results are received. Below is the separate window where results are shown:

```
FREQUENCY/Hz      300    1000   3000
RECEIVED LEVEL    120     122    179   OUT OF RANGE
```

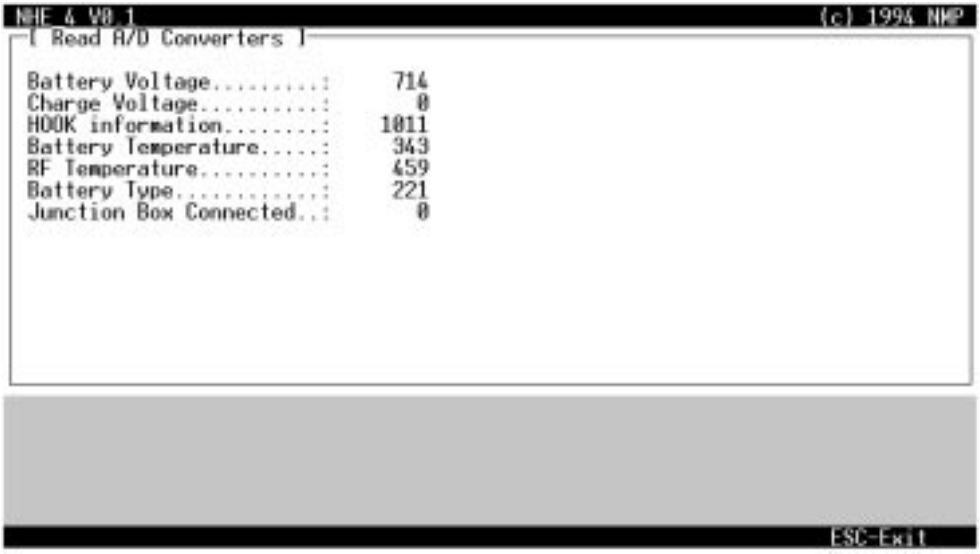
Received level value has scale from 0 to 256.

3.6 – Logic Controls

After this selection new window is shown:

3.6.1 – Read A/D Converters

After this selection new window is shown:



No value is shown when selected. When correspondent messages are received, the A/D converter values (10 bits decimal numbers) are displayed and read again. The exit is made with <Esc>.

3.6.2 – Buzzer Volume

The buzzer volume is changed by using the number or <Enter> key. Three different values can be selected. The frequency used in buzzer control is 2700 Hz. When logic controls menu is exited with <Esc> key the buzzer volume is switched always off.

3.6.3 – LCD Test Display

The LCD display is changed by using the number or <Enter> key. Two different test displays can be selected. When logic controls menu is selected, the display is controlled to the state shown in the menu.

– In test display 1 all indicators are displayed and the display is filled with chessboard letters.

– In test display 2 none of the indicators are displayed and the display is filled with inverse chessboard letters.

3.7 – MCU Selftests

When this selection is used, user is informed that if he gives <Y> answer the MCU will be controlled to the special test mode; reset will be made and MCU SW will be run only inside MCU ROM code (minimum mode). Also the test results (about those tests that have been executed after last power up) will be asked from phone. <N> and <Esc> keys will cancel the selection.

The next menu will be shown when the selection is accepted:

NHE 4 V0.1
(c) 1994 NMP
[MCU Self-tests]
1 Run Internal Test.....: OK
2 Run RAM BUS Test.....: OK
3 Run ROM BUS Test.....: OK
4 Run ROM Data Test.....: OK
5 Run ASIC BUS Test.....: OK
6 Run ASIC Timer & IRQX Test...: OK
7 Run ASIC Timer & NMI Test....: OK
8 Run Audio Codec Test.....: OK
9 Run RAM Component Test.....: OK
A Run Ext. ROM Checksum Test...: OK
B Run Display Driver Test.....: OK
C Run ASIC Type Test.....: OK
D Run EEPROM Component Test....: OK
E Run EEPROM BUS Test.....: OK
F Run Software Reset Test.....: NOT EXECUTED
G Run Power-off Test
F1-Help F8-Bus Test
ESC-Exit

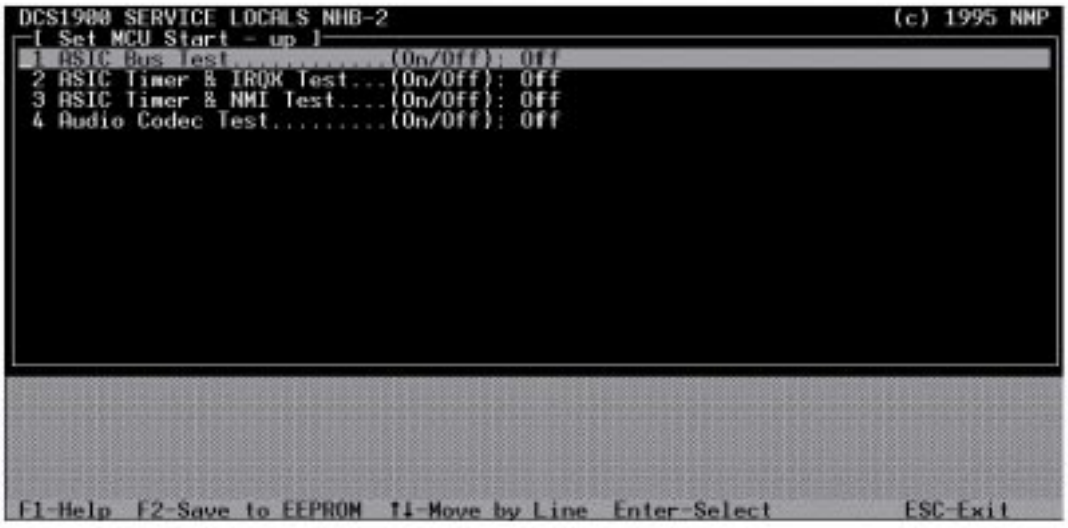
IMEI test cannot be executed with this menu.

When the selection is made, the test result is waited and special waiting window is shown. The test result will be shown to the user after each menu selection. If no response was received in the defined time, an error message is shown and ”no response” text will be shown in the menu.

Note that power–off test (if passed) turns power off and power should be reconnected by using the phones keypad after the successful test. After the power has been connected to phone, the normal start–up routines are made and the self–test results are shown in the MCU self–tests menu (i.e. all other than power–up self–tests are in NOT EXECUTED state after the power–up routines).

Test results will be one of the next: no response, OK, NOT EXECUTED, FAILED. Note that power–off test have no values, because if test has been passed, power has been turned off. If power–off test fails a special error message window is shown. If no response is received to power off test message in a few seconds, the user is informed by special info window, where user is asked to turn the power on and then press the return key.

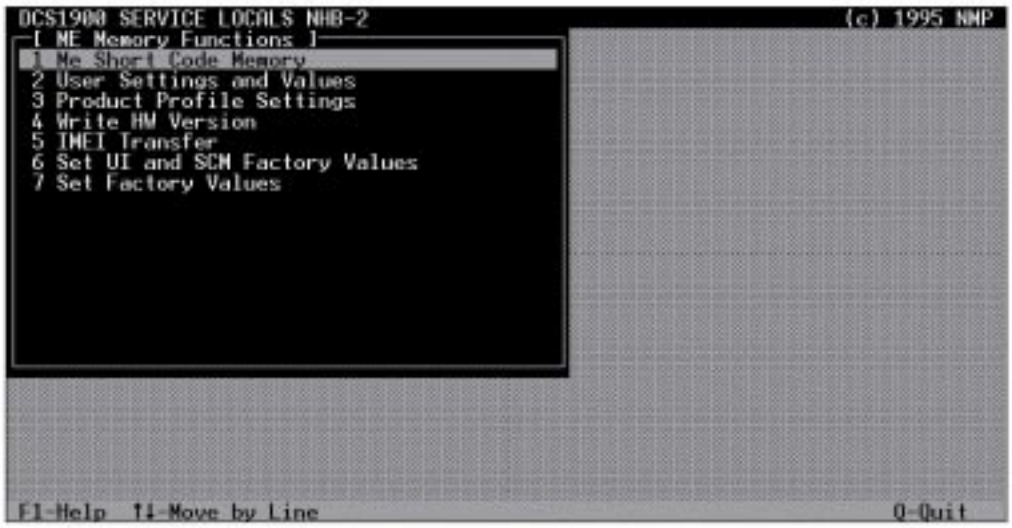
3.8 – Set MCU Start–up Self–tests


DCS1900 SERVICE LOCALS NHB-2
(c) 1995 NMP
[Set MCU Start - up]
1 ASIC Bus Test.....(On/Off): Off
2 ASIC Timer & IRQX Test...(On/Off): Off
3 ASIC Timer & NMI Test....(On/Off): Off
4 Audio Codec Test.....(On/Off): Off
F1-Help F2-Save to EEPROM ↑↓-Move by Line Enter-Select ESC-Exit

This menu is used for changing the state of the EEPROM selectable tests. When selection is ”on”, the test will be run every time when automatic start–up self–tests are activated (e.g. in power–up).

When menu is selected, the previous values will be read from the MCU EEPROM and shown on the screen. When <Esc> is used, user is asked to confirm the EEPROM values saving. Error handling is done as in other functions which read and save EEPROM values.

4 – ME Memory Functions


DCS1900 SERVICE LOCALS NHB-2
(c) 1995 NMP
[ME Memory Functions]
1 Me Short Code Memory
2 User Settings and Values
3 Product Profile Settings
4 Write HW Version
5 IMEI Transfer
6 Set UI and SCM Factory Values
7 Set Factory Values
F1-Help ↑↓-Move by Line
Q-Quit

The user interface of the phone is disabled (keypad cannot be used, display is not updated and tones are not generated) when this selection is made. When this menu is exited, user interface is enabled again.

When program should save values to ME memory in any selection, it asks for confirmation. If <Y> key is used, values are saved to the memory. If <N> or <Esc> key is used, the values are not saved to the memory. If any other key is used, nothing happens.

4.1 – ME Short Code Memory

When this selection is activated, empty phone number and name table is displayed. Short code memory data is read only from phones internal memory (not from SIM card). Before memory values are read, memory locking is removed (MCU removes locking automatically) and it is not needed to return to previous value after this selection. For instance the next window data is shown when values have been received from memory:

20 phone numbers and names are seen at the same time on the window. Memory position numbers are on the left side of the window. Phone number field has 30 and name field 20 character positions and there is one space between these fields on the screen. When <Enter> key is pressed, the selected number can be edited. When the number editing is ended with the <Enter> key, the name is displayed and it can be edited. If <Esc> key is used, only changes on the edited field are removed.

<F2> and <F3> keys are used for writing/reading all phone numbers and names (except memory position zero) to/from the memory of the ME. When values are either tried to be written to ME or read from ME, the user is asked to confirm the selection. When values are read from ME, they are cleared from the PC display and shown again when received from ME.

Information window is shown during writing and reading. The window shows the memory position number which is under reading or writing. When all values are read (responses received) or written, waiting window is removed and short code window is shown. The waiting state can be broken with <Esc> key. If writing to the ME is broken, only part of the values in the memory may be updated. If reading is broken, part of the values (values received before break command) may come to the display and PC memory.

All values can be saved to file and read from file with <F4> and <F5> keys respectively. The file name is asked when function is selected. The previous file name is default value. Both save and read functions have common default file name. After start up no default file name is used.

When clear function (<F6> key) is used, all number and name fields are cleared on the PC memory. Before clear function is made the confirmation is asked from the user. If user also wants to clear ME memory area, he has to use <F2> key after <F6> key.

When either phone number or name is tried to be edited, the characters are checked. Only correct characters are accepted. If values are read from file and wrong characters are noticed, error message is shown and the wrong characters are replaced by question marks.

Accepted characters in the number field are:

- all numbers 0..9; hexadecimal values: 30H..39H
- * (asterisk); hexadecimal value: 2AH
- # (hash); hexadecimal value: 23H
- p, P; hexadecimal value: 70H, 50H
- w, W; hexadecimal value: 77H, 57H
- + (plus); hexadecimal value: 2BH

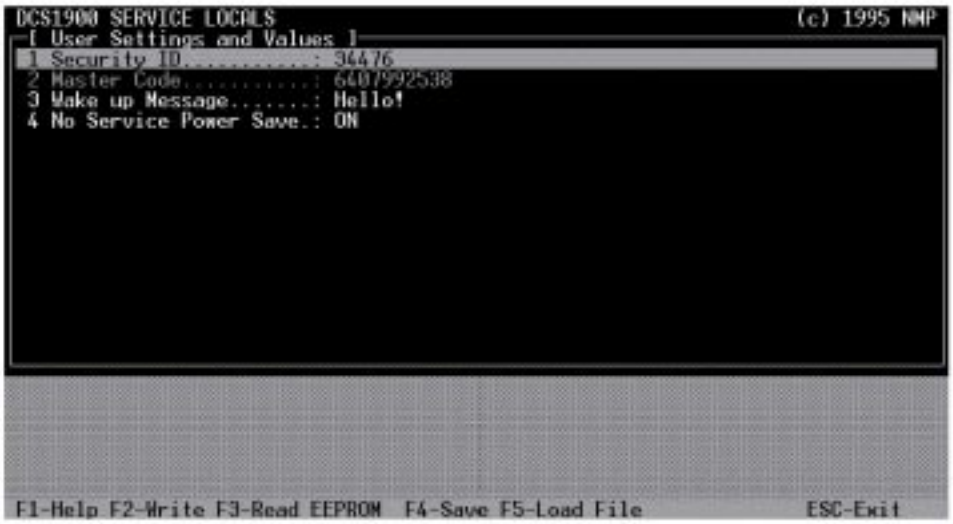
The accepted characters to ME name field are 0AH..FFH. Characters are changed between phone and PC character codes when values are received from ME and before sending to ME. Some DOS versions or code page selections in PC may cause differences between PC display and ME display.

When function is exited with <Esc> key, the program will ask if the ME short code memory data is saved to the ME or not. If <Y> key is used, the ME short code memory data is saved to the ME and exit from the function is done. If <N> key is used, exit is done from the function and nothing is saved to the memory of ME. If <Esc> key is used, the function can be continued. If any other key is used nothing happens.

Information window is shown during writing. The window tells the memory position number which is under writing. When all values have been written, waiting window is removed and ME memory functions menu is shown. The waiting state can be broken with <Esc> key. If writing to the ME memory is broken, only part of the values in the ME may be updated.

4.2 – User Settings and Values

After this selection new window is shown:


DCS1900 SERVICE LOCALS
(c) 1995 NMP
[User Settings and Values]
1 Security ID.....: 36476
2 Master Code.....: 6407992538
3 Wake up Message.....: Hello!
4 No Service Power Save.: ON
F1-Help F2-Write F3-Read EEPROM F4-Save F5-Load File
ESC-Exit

After menu selection all needed user settings will be read from the ME. If a reading error happens, an error message is shown and the ME memory functions menu is displayed when any key is pressed.

When menu is exited with <Esc> key and if some user settings and values have been read from ME or file to PC memory, the program behaves same way as with short code window. If no settings and values have been read to PC memory and <Esc> key is used, the previous menu is shown and no data is written to the memory of ME.

<F2> Write to ME

The program asks if the user settings and values will be saved to the ME or not. If <Y> key is used, all data is saved to the ME. If <N> or <Esc> key is used the user settings and values menu will come to the screen. If any other key is used, nothing happens.

Information window is shown during writing. The window tells how long time it will approximately take to write values. When all values are sent and responses received, waiting window is removed and user settings and values menu is shown. The waiting state can be broken with <Esc> key. If writing to the ME is broken, only part of the values in the ME may be changed.

<F3> Read from ME

When this selection is used, security code, lock code and wakeup message values from the memory of ME are read to PC if the user gives positive answer to a confirmation question. Information window, which tells how long time it will approximately take to read values will be shown. When all values are received, waiting window is removed and user settings and values menu is shown. The waiting state can be broken with <Esc> key. If <Esc> is used, all user data is deleted in the PC memory and user settings and values menu is shown.

If the ME data is corrupted when reading, an error message is shown. The message is removed when any key is pressed.

<F4> Save to File

The window is made and the program asks the file name. The user settings and values are saved when the name is ended with <Enter> key.

<F5> Open from File

The user data is read from given file to PC memory. The file name is given as with save to file selection.

Both save to file and open from file function has default name which is previously used name. For instance if user data was saved to file USERA.DAT and open function is activated the default value is USERA.DAT. If only <Enter> key is pressed default value is used. If <Esc> key is used, the function will be interrupted. If illegal DOS filename is used or there isn't load file with given name error message will come to the display.

Note that file name handling works in the same way with setup file.

4.2.5 – Security Code

The security code is put to the text editing window, when this function is activated. The code can be edited in the window. Note that code is saved to the ME memory together with other user settings and values. Only digits are accepted for security code.

4.2.6 – Master Code

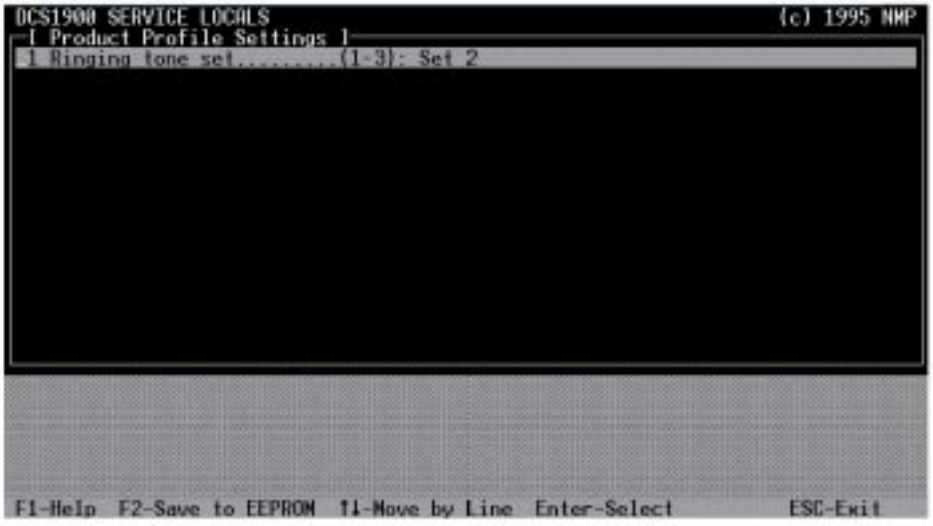
Master code comes to the text window but it can't be edited.

4.2.7 – Wake Up Message

Wake up message comes to the text editing window and it can also be edited. When the editing is tried to be ended, the characters are checked. If wrong characters are noticed, error message is shown and editing is not ended. The wake up message name can have same characters as short code memory name. The maximum length is 30 characters.

4.3 – Product Profile Settings

When product profile pettings selection is activated the product profile information is read from EEPROM. If the information is not received within 2 seconds an error message is shown and the ME memory functions menu is displayed. Otherwise the product profile settings menu is displayed, where the user can select needed features.


DCS1900 SERVICE LOCALS
(c) 1995 NMP
[Product Profile Settings]
1 Ringing tone set.....(1-3): Set 2
F1-Help F2-Save to EEPROM ↑↓-Move by Line Enter-Select ESC-Exit

The menu items will be added when new features will be added to product profile.

When <Esc> key is used in this menu, the program will ask are the values saved to the EEPROM or not. If <Y> key is used, values are saved to the EEPROM and the ME memory functions menu is shown. If <N> key is used the ME memory functions menu is shown and nothing is saved to the EEPROM. If <Esc> key is used the product profile setting menu is shown and the values can be changed. If any other key is used nothing happens.

4.4 – Write HW Version

HW version is four digits.

4.6 – IMEI Transfer

The purpose of this function is to transfer the IMEI code from an old system board to a new system board. This function is used when you are changing the system board.

When this selections is made the user is asked to confirm the function with <Y> key. Pressing the <N> or <Esc> keys the selection is cancelled. If any other key is used, nothing happens.

When <Y> key is pressed the IMEI is read from EEPROM to PC. When the IMEI code is received by PC, information comes to the screen and the IMEI code is destroyed in the EEPROM. After clearing the IMEI number, the old system board is unusable.

The IMEI is situated in the PC at this moment. If you quit the Service software, the IMEI data will be lost.

Now you can switch the phone power off and exchange the system boards and switch the phone power on again. A ”Selftest failed” –message will appear in the phones display.

Now user should press the <Enter> key as said in the PC’s screen. After pressing the <Enter> key the IMEI will be transferred to the new system board. The IMEI data in the PC will be cleared and cannot be reused.

Now user should go to the main menu and select the initialize phone selection to reset the phone. If the phone does not show the ”Selftest failed”–message, the transfer is successful. In case of the ”Selftest failed”–message, you must contact technical support of local importers.

4.7 – Set UI and SCM factory Values

Factory values to phone user interface parameters are set and short code memory is cleared with this function (special messages are sent to MCU).

When selection is accepted the waiting window is made. When command is done (response message received) the waiting window is removed. The waiting window tells the needed time. If the waiting window is removed with <Esc> key, it has no effect to UI and SCM Factory set command. <Esc> key only causes that it is impossible to see when UI factory set is done.

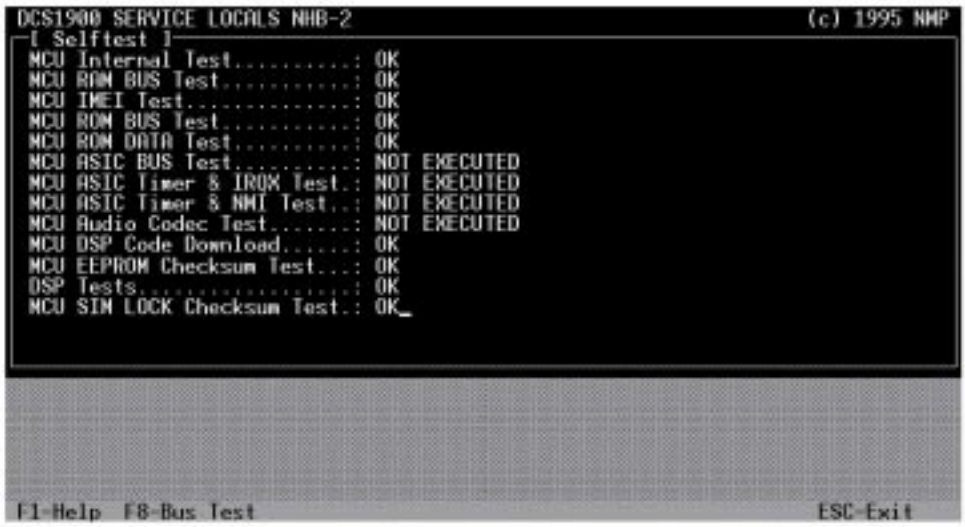
4.8 – Set Factory Values

Factory values setting message is sent to MS with this function.The user is asked to confirm the function with <Y> key.

When selection is accepted the waiting window is made. When factory set is done (response message received) the waiting window is removed. The waiting window tells the needed time. If the waiting window is removed with <Esc> key, it has no effect to factory set command. <Esc> key only causes that it is impossible to see when factory set is done.

After the factory values are set user should make all tunings of the phone.

5 – Power–up Selftests


DCS1900 SERVICE LOCALS NHB-2
(c) 1995 NMP
[Selftest]
MCU Internal Test.....: OK
MCU RAM BUS Test.....: OK
MCU IMEI Test.....: OK
MCU ROM BUS Test.....: OK
MCU ROM DATA Test.....: OK
MCU ASIC BUS Test.....: NOT EXECUTED
MCU ASIC Timer & IRQX Test.: NOT EXECUTED
MCU ASIC Timer & NMI Test..: NOT EXECUTED
MCU Audio Codec Test.....: NOT EXECUTED
MCU DSP Code Download.....: OK
MCU EEPROM Checksum Test...: OK
DSP Tests.....: OK
MCU SIM LOCK Checksum Test.: OK
F1-Help F8-Bus Test
ESC-Exit

When the window is activated, all test result fields have value no response. When responses are received, the values will be updated. When <Esc> key is used, the previous menu will come to the screen. Below is the list of DSP processor test faults. Only one fault value is indicated in the DSP processor self-test message. MCU test results are indicated one by one on the separate lines.

– RAM BUS fault
– ASIC BUS fault
– RFI BUS fault
– Download error

Note that DSP test results can be asked from DSP only when all MCU tests have been passed. MCU test results will be one of the next: No Response, OK, NOT EXECUTED, FAILED

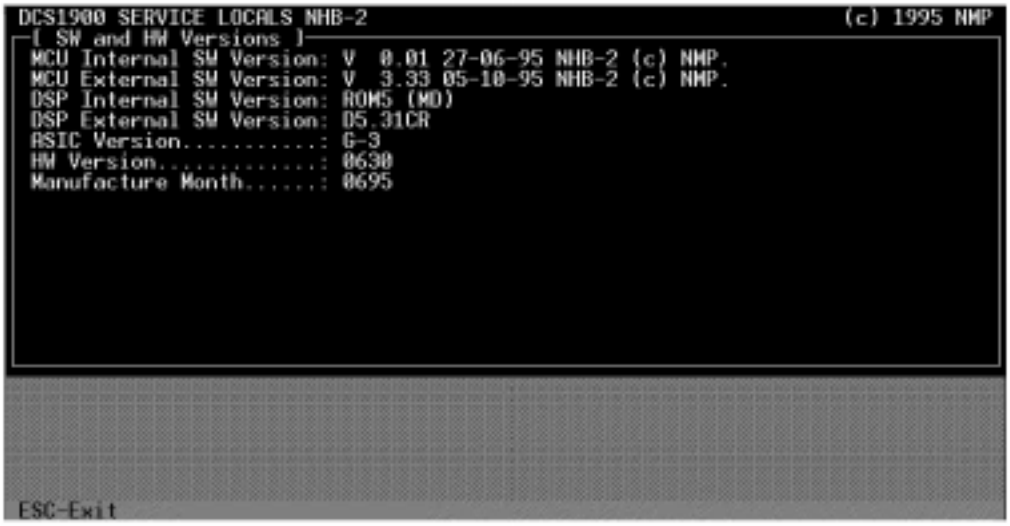
When <F8> key is pressed, the bus test window will be shown. The test results are from the first failed MCU BUS test. When none of MCU BUS tests has been failed, user is informed by the special message on the screen after pressing of the <F8> key, and the below told test data cannot be displayed. <Esc> key removes BUS test window and returns previous described test result window. The window includes also the name of the failed BUS test.

```
Address Written/Read   Address Written/Read
zzzz    xxxxxxxx  XX/  zzzz    xxxxxxxx  XX/
        yyyyyyyy  YY           yyyyyyyy  YY
zzzz    xxxxxxxx  XX/
        yyyyyyyy  YY
```

```
zzzz      = hexadecimal address
xxxxxxxx  = binary written data
yyyyyyyy  = binary read data
xx        = hexadecimal written data
yy        = hexadecimal read data
```

6 – SW and HW Versions

When versions selection is used a new window will be generated.


DCS1900 SERVICE LOCALS NHB-2
(c) 1995 NMP
[SW and HW Versions]
MCU Internal SW Version: V 0.01 27-06-95 NHB-2 (c) NMP.
MCU External SW Version: V 3.33 05-10-95 NHB-2 (c) NMP.
DSP Internal SW Version: ROM5 (MD)
DSP External SW Version: D5.31CR
ASIC Version.....: G-3
HW Version.....: 0630
Manufacture Month.....: 0695
ESC-Exit

The window has next information:

MCU internal SW version:	XX.YY dd–mm–yy ZZ–Z (c) NMP.
MCU external SW version:	XX.YY dd–mm–yy ZZZ–ZZZ (c) NMP.
DSP internal SW version:	ROMx (Lj)
DSP external SW version:	sx.zzzz
ASIC version:	AAA
HW version:	BBBB
Manufacture Month:	MMYY

The next symbols are used:

Symbol	Meaning
XX.YY	SW version e.g. 3.24
dd–mm–yy	Day–month–year e.g. 30–01–95
ZZ–Z	Product type e.g. NH–1
ZZZ–ZZZ	Product type e.g. NHE–4XN
AAA	three ASCII characters
BBBB	four digits version number
MMYY	Month and year e.g. 0295
x	DSP version number digit
j	DSP version number digit
s	DSP SW version ymbol (P or void)
zzzz	the running version number of the external memory program

If some SW version is not received spaces are shown in that version number place. The function is broken with <Esc> key.

7 – Phone Mode

With this function you can change the phone state (PCS or local mode).

When PCS is selected the normal start up functions take place in the phone and the phone is in normal operating mode.

When you are selecting the PCS mode, the phone tries to synchronize into the base station and the waiting window appears into the screen. If the phone gets the connection, the waiting window will be removed (you do not need press the <Esc> key) and the AFC value witch used can be read from the phone. This value is used when selecting local mode.

If the phone does not connect the base station, the middle value of the AFC is used in the local mode.

When the local mode is selected the phone is deactivated to enable e.g. special RF tuning, adjustment values are requested from the phone and used to control hardware and the AFC value is stored in the AFC control register.

Q – Quit

With this selection you can terminate (quit) the program.

Appendix I

Installing the service software on PC hard disk

The program is delivered on a diskette and is protected with a protection key PKD–1, which must be attached to the parallel port when the service software is being used.

The program can also be installed on the hard disk, which is recommendable to obtain maximum data access rate.

Do not lose your original diskette. It will be needed when upgrading the program !

If you are planning to use PCL–Start service software, you must install it before installing the Service software. See PCL–Start installation instructions.

To install the Service software, proceed as follows:

1.	insert the new service sodtware diskette into drive A: of your PC	
2.	log into drive A:	*type A: and press <Enter>*
3.	start INSTALL.EXE and install service software into drive C:	*type **INSTALL C:** and press <Enter>*

Appendix II

Starting options for service software

The program is started by entering the following command:

NHB2SERV [–serial port] [–video mode] [–text mode] [–file name]

where:

[–serial port] =	the communication port used for M2BUS (COM1 or COM2). –c1 or –c2
[–video mode] =	video control method (BIOS video or HW video). –vb or –vh (default) Note: If PCLocals screen updating is slow, try change this option.
[–text mode] =	screen text mode (CO80, MONO, BW80 or last mode). –tco80, –tmono, –tbw80 or –tlast (default)
[–file name] =	name of the configuration file. –ffilename (default filename is –fNHE_4.CON)

Example 1; The program is to be used to test the NHB–2 phone.

NHB2SERV <Enter>

Example 2; The program is used to test the NHB–2 phone, using a PC with black–and–white display. In addition, use of BIOS controls is desirable to avoid compatibility problems.

NHB2SERV –TBW80 –VB <Enter>

Appendix III

Vocabulary

AFC	Automatic Frequency Control
AGC	Automatic Gain Control
CGA	Color Graphics Adapter
DSP	Digital signal processor which controls radio interface and speech coding/decoding
EEPROM	Memory for adjustment parameters (Electrically erasable and programmable read only memory)
EGA	Enhanced Graphics Adapter
HF	Hands–Free
HS	Handset
HW	Hardware
ID	Identification
IMEI	International Mobile Equipment Identification code
M2BUS	Serial communication bus which can be connected to accessory devices and test PC
MCU	Master Control Unit processor
ME	Mobile Equipment
MS	Mobile Station
PC	IBM PC/AT or compatible personal computer
PCN	Personal Communications Network
RF	Radio Frequency parts
RSSI	Received Signal Strength Indication
SCM	Short Code Memory
SIM	Subscriber Identification Module interface
SW	Software
UI	User interface
VGA	Video Graphics Array